APPEAL BRIEF UNDER 37 C.F.R. § 41.37

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Nanjunda Swamy S. Jamadagni	Examiner: Mai T. Tran
Serial No.: 10/034,689	Group Art Unit: 2129
Filed: December 28, 2001	Docket: 1488.015US1

For: A METHOD OF NETWORK MODELING AND PREDICTIVE EVENT CORRELATION IN A COMMUNICATION SYSTEM BY THE USE OF CONTEXTUAL FUZZY COGNITIVE MAPS

APPEAL BRIEF UNDER 37 CFR § 41.37

Mail Stop Appeal Brief- Patents
Commissioner for Patents
P.O. Box 1450
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Sir:

The Appeal Brief is presented in support of the Notice of Appeal to the Board of Patent Appeals and Interferences, filed on May 12, 2006, from the Final Rejection of claims 1-63 of the above-identified application, as set forth in the Final Office Action mailed on December 13, 2005.

The Commissioner of Patents and Trademarks is hereby authorized to charge Deposit Account No. 19-0743 in the amount of $500.00 which represents the requisite fee set forth in 37 C.F.R. § 41.2(b)(2). The Appellants respectfully request consideration and reversal of the Examiner's rejections of pending claims.

1. REAL PARTY IN INTEREST

The real party in interest of the above-captioned patent application is the assignee, SASKEN COMMUNICATION TECHNOLOGIES LIMITED.

2. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to Appellant that will have a bearing on the Board's decision in the present appeal.

3. STATUS OF THE CLAIMS

The present application was filed on December 31, 2002 with claims 1-63. A non-final Office Action mailed April 22, 2005, rejected all the claims. In response filed on October 24, 2005, claims 10, 27, 30, 37, 46, 50 and 58 were amended. A Final Office Action (hereinafter "the Final Office Action") was mailed December 13, 2005. Claims 1 and 22 were amended in a response dated February 13, 2006, however, the amendment was not entered. Claims 1-63 stand twice rejected, remain pending, and are the subject of the present Appeal.

4. STATUS OF AMENDMENTS

Claims 1 and 22 were amended in a response dated February 13, 2006, however, the amendment was not entered. Thus, no amendments have been made subsequent to the Final Office Action dated December 13, 2005.

5. SUMMARY OF CLAIMED SUBJECT MATTER

Some aspects of the present inventive subject matter include, but are not limited to, systems and methods for diagnosing problems from multiple events that may be monitored. It can be very difficult in prior networks to identify a root problem because the problem may generate events in many different related parts of the system. These events may be going off in lots of different areas, making it difficult to identify the source of the real problem. In independent claim 1, a method diagnoses a problem from multiple events in a system of managed components (110, 800) which are generating real-time events (FIG. 9) of problems. Fuzzy cognitive maps (FCMs) including causally equivalent FCM fragments (166, 1530) are formed using network element interdependencies derived from a database (160) defining the network managed objects (162) and event notifications that convey the state of one or more managed objects. Generated incoming real-time events (FIG. 9) are sampled (130 – see page 9, line 25 et seq., 1540) from the system. Problems are diagnosed (140 – see page 10, line 7 et seq., 1570) by mapping the sampled events to the formed FCM fragments (140 – see page 10, line 15 et seq., 1550).

In some embodiments, the FCM fragments are formed by determining event nodes (1510 – see pages 28-30) from events in the database, identifying concept nodes (1520) from the determined event nodes, and forming FCM fragments (1530) including interdependencies between the concept and event nodes using the determined event nodes and the identified concept nodes. Diagnosing the sampled events (1540) involves mapping the sampled real-time events to the formed FCM fragments (1550) including determined event nodes to evaluate the effect of the mapped event nodes on the identified concept nodes using the determined interdependencies, identifying the problems (1560) by analyzing the concept nodes based on the outcome of the evaluation, and diagnosing the problems (1570) based on the outcome of the analysis. Significant detail regarding formation and use of FCMs can be found beginning at line 22 on page 11 of the application. Many of such details are claimed in dependent claims.

Independent claim 22 describes a method for diagnosing problems from multiple events in a communication network including managed components generating real-time events of problems. References to Figures and the specification are the same as for claim 1. Fuzzy cognitive maps (FCMs) are also formed in this method, including causally equivalent FCM fragments using network element interdependencies. Generated incoming real-time events from the network are also sampled. The method diagnoses each of the generated problems by mapping the received sampled events to the formed FCM fragments.

Independent claim 25 is a computer readable medium version of claim 1.

Independent claim 33 is a computer system that diagnoses problems from multiple events in a system of managed components generating real-time events of problems. Shown at least in FIGS. 1 (pages 8-11), 8 (pages 18-19) and 16 (pages 30-31), the system includes a storage device (160, 1612, 1614), an output device (150, 1618), and a processor (1602) programmed to repeatedly perform a method similar to that of claim 1.

Independent claim 41 (see FIG. 1, pages 8-11) describes an event-correlation system (100) to diagnose problems from multiple incoming real-time events in a communication network (110) of managed components generating real-time events of problems (130). An event-analyzer (140) forms fuzzy cognitive map (FCM) fragments (166) using network element interdependencies derived from a database (160) defining the network managed objects (162) and event notifications that convey the state of one or more managed objects. An event-processing module (130) is coupled to the event-analyzer and samples generated incoming real-time events from the network. The analyzer diagnoses the problems from the sampled events by mapping the sampled events to the formed FCM fragments.

This summary does not provide an exhaustive or exclusive view of the present subject matter, and Appellant refers to the appended claims and its legal equivalents for a complete statement of the invention.

6. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-18, 22-31, 33-39, 41-58, and 62-63 were rejected under 35 U.S.C. § 102(b) for anticipation by Ndousse et al., "Computational Intelligence for Distributed Fault Management in Networks Using Fuzzy Cognitive Maps".

Claims 19-21, 32, 40, and 59-61 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ndousse as applied to claims 1-18, 22-31, 33-39, 41-58, and 62-63 above, in view of Zhi-Qiang Liu et al., "Contextual Fuzzy Cognitive Map for Decision Support in Geographic Information Systems", and further in view of Thierry Marchant, "Cognitive Maps and Fuzzy Implications."

7. ARGUMENT

A. Summary of Arguments

Appellant respectfully submits that the pending claims are in allowable form for various reasons as detailed in the arguments below. In particular, Appellant asserts that the references do not teach, disclose or suggest sampling of incoming real time events as recited in each independent claim. Several of the independent claims also recite utilization of a computer to form the fuzzy cognitive maps (FCMs), which is not shown in the references.

B) The Applicable Law

1. 35 U.S.C. §102(b)

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. M.P.E.P § 2131. To anticipate a claim, a reference must disclose every element of the challenged claim and enable one skilled in the art to make the anticipating subject matter. PPG Industries, Inc. V. Guardian Industries Corp., 75 F.3d 1558, 37 USPQ2d 1618 (Fed. Cir. 1996). The identical invention must be shown in as complete detail as is contained in the claim. Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

2. 35 U.S.C. § 103(a)

In rejecting claims under 35 U.S.C. § 103, the Examiner bears the initial burden of establishing a *prima facie* case of obviousness. *In re Oetiker*, 977 F.2d 1443, 1445, 24 USPQ 1443, 1444 (Fed. Cir. 1992). *See also In re Piasecki*, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984). The Examiner can satisfy this burden by showing that some objective teaching in the prior art or knowledge generally available to one of ordinary skill in the art suggests the claimed subject matter. *In re Fine*, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). Only if this initial burden is met does the burden of coming forward with evidence or argument shift to the Appellants. *Oetiker*, 977 F.2d at 1445, 24 USPQ at 1444. *See also Piasecki*, 745 F.2d at 1472, 223 USPQ at 788.

When determining obviousness, "the [E]xaminer can satisfy the burden of showing obviousness of the combination 'only by showing some objective teaching in the prior art or individual to combine the relevant teachings of the references". *In re Lee*, 277 F.3d 1338, 1343, 61 USPQ2d 1430, 1434 (Fed. Cir. 2002), citing *In re Fritch*, 972 F.2d 1260, 1265, 23 USPQ2d 1780, 1783 (Fed. Cir. 1992). "Broad conclusory statements regarding the teaching of multiple references, standing alone, are not 'evidence.'" *In re Dembiczak*, 175 F.3d 994, 999, 50 USPQ2d 1614, 1617. "Mere denials and conclusory statements, however, are not sufficient to establish a genuine issue of material fact." *Dembiczak*, 175 F.3d at 999, 50 USPQ2d at 1617, citing *McElmurry v. Arkansas Power & Light Co.,* 995 F.2d 1576, 1578, 27 USPQ2d 1129, 1131 (Fed. Cir. 1993).

The Federal Circuit states that, "[t]he mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification." *In re Fritch*, 972 F.2d 1260, 1266 n.14, 23 USPQ2d 1780, 1783-83 n.14 (Fed. Cir. 1992), citing *In re Gordon*, 733 F.2d 900, 902, 221 USEQ 1125, 1127 (Fed. Cir. 1984). In addition, the court stated in *In re Lee*, 277 F.3d 1338, 1343, 61 USPQ2d 1430, 1433 (Fed. Cir. 2002), that when making an obviousness rejection based on combination, "there must be some motivation, suggestion or teaching of the desirability of making the specific combination that was made by Appellants" (quoting *In re Dance*, 160 F.3d 1339, 1343, 48 USPQ2d 1635, 1637 (Fed. Cir. 1998).

C) Discussion of the rejection of claim 1 under 35 U.S.C. § 102(b) as being anticipated by Ndousse et al., "Computational Intelligence for Distributed Fault Management in Networks Using Fuzzy Cognitive Maps".

Claims 1-18, 22-31, 33-39, 41-58, and 62-63 were rejected under 35 U.S.C. § 102(b) for anticipation by Ndousse et al., "Computational Intelligence for Distributed Fault Management in Networks Using Fuzzy Cognitive Maps". There is clear error in the rejection, as independent claims 1, 25, 33, includes "sampling generated incoming real-time events from the system.", and Ndousse et al., does not describe such element. Independent claim 41 also includes "sample generated incoming real-time events from the network". Since an element of each of the

independent claims is lacking from the reference, a proper *prima facie* case of anticipation has not been established, and the rejection should be withdrawn.

Independent claims 1, 25 and 33 recites "sampling generated incoming real-time events from the system." Independent claim 41 also samples generated incoming real time events. No mention of such sampling is found in the reference. The Office Action points to page 1558, left col., lines 5-8 of Ndousse et al., as describing this element. Such langauge, if referring to the abstract, indicates that "The dynamic features of FCM are exploited to characterize the time-varying aspects of network faults, while its graphical features are used as a framework for representing the distributed properties of fault propagation." No mention of sampling is found in this language. If the reference is to the Introduction, that recites: "Its essential features provide a rapid and intelligent solution to the following critical issues. – Diagnosis and location of the faulty components of the network." This language also fails to describe sampling. Since at least one element has not been properly shown to be in the reference, a proper prima facie case of anticipation has not been established, and the rejection should be reversed.

The claims also utilize a computer to form the fuzzy cognitive maps, expressly in claims 25 and 33, and by implication in claims 1 and 41, since they sample system generated real-time events and map the sampled events to diagnose problems. This would simply be impossible to do in real time by an expert, or within a time frame acceptable for diagnosing problems. In Ndousse et al., FCMs are constructed by experts, not by a computer. This is illustrated by the fact that no computer implemented methodology for creating FCMs is disclosed, the fact that FIG.s 4 and 5 illustrated FCMs formed by two experts, and the text in the second column of page 1560, beginning at the heading "IV. Aggregation FCM" recites that the causal viewpoint of each expert leads to an FCM with different causal weights. As such, the claims clearly distinguish from Ndousse et al., and the rejection should be withdrawn.

Additionally, claim 1 recites forming fuzzy cognitive maps (FCMs) including causally equivalent FCM fragments using network element interdependencies derived from a database. The corresponding text describing this element is found in the application at least on page 8 with reference to event analyzer 140.

Claims 1, 25 and 33 also distinguish from Ndousse et al., in that the FCM fragments are formed. The Office Action cites page 1559, left col., lines 36-37 of Ndousse et al., as describing this feature. However, that language does not appear to describe the creation of the FCM fragments, but merely describes that "the FCM denote faulty managed objects or concepts, while the arcs denote fault propagation between managed objects or network fault concepts." This is clearly not describing how to create an FCM fragment, but only what it represents. Claims 1, 25 and 33 describe how to create one using computer elements. Still further, no mention in Ndousse et al., was found regarding the use of event notifications that convey the state of one or more managed objects to create FCM fragments as claimed.

Several claims are now individually discussed. The claims that are not expressly discussed depend from claims that are believed allowable at least on the same basis as the claims from which they depend.

Claim 1

Claim 1 distinguishes Ndousse et al., in at least two respects, either of which is sufficient to reverse the rejection. First, claim 1 clearly indicates that incoming real-time events from the system are sampled, and the sampled events are used to form the FCM fragments. Second, the FCM fragments are constructed by a computer in claim 1 at least by implication. Ndousse et al. does not describe either limitation.

The Examiner points to page 1558, left col., lines 5-8 of Ndousse et al., as describing the element of claim 1 that includes sampling. This reference to lines of Ndousse et al., is the only analysis provided by the Examiner. There is nothing to indicate how such language describes sampling. As such, the rejection lacks specificity, and the rejection should be reversed. Such langauge of Ndousse et al., if referring to the abstract, indicates that "The dynamic features of FCM are exploited to characterize the time-varying aspects of network faults, while its graphical features are used as a framework for representing the distributed properties of fault propagation." No mention of sampling is found in this language. If the reference is to the Introduction, that recites: "Its essential features provide a rapid and intelligent solution to the following critical

issues. – Diagnosis and location of the faulty components of the network." This language fails to describe sampling, and a review of Ndousse et al., reveals no mention of sampling. Still further, no mention of events is found. Since at least one element has not been properly shown to be in the reference, a proper prima facie case of anticipation has not been established, and the rejection should be reversed.

Ndousse et al., while introducing the concept of using FCMs to diagnose network faults, clearly describes that the FCMs are constructed by experts, not by a computer. This is illustrated by the fact that no computer implemented methodology for creating FCMs is disclosed, the fact that FIGS. 4 and 5 illustrated FCMs formed by two experts, and the text in the second column of page 1560, beginning at the heading "IV. Aggregation FCM" recites that the causal viewpoint of each expert leads to an FCM with different causal weights.

Claim 1 describes generating FCM fragments, implicating use of a computer to do so. Specifically, claim 1 recites forming fuzzy cognitive maps (FCMs) including causally equivalent FCM fragments using network element interdependencies derived from a database. The corresponding text describing this element is found in the application at least on page 8 with reference to event analyzer 140.

Thus, claim 1 clearly distinguishes from Ndousse et al., in that the FCMs are computer generated. The Office Action cites page 1559, left col., lines 36-37 of Ndousse et al., as describing this feature. However, that language does not appear to describe the creation of the FCM fragments, but merely describes that "the FCM denote faulty managed objects or concepts, while the arcs denote fault propagation between managed objects or network fault concepts." This is clearly not describing how to create an FCM, but only what it represents. Claim 1 describes how to create one. Still further, no mention in Ndousse et al., was found regarding the use of event notifications that convey the state of one or more managed objects to create FCM fragments as claimed.

Claim 2

Claim 2 depends from claim 1 and recites determining event nodes and concept nodes from determined event nodes. The FCM fragments, including interdependencies between the

concept and event nodes are formed using the determined event nodes and the concept nodes. Ndousse et al., in the portions cited by the Examiner: page 1559, left col., lines 41-42 describe the nodes as being representative of objects and concepts, not events and concepts as claimed. The cited language describes edges joining objects, and then indicates that the causal strength is based on the knowledge of network experts. This actually confirms the premise that the FCM in Ndousse et al., is created by an expert, not by a computer system as claimed. Further, the language describes the content of an FCM, not how it is made as claimed. While including concept nodes, it lacks a description of identifying concept nodes from the event nodes as claimed. Thus, Ndousse et al., functions entirely different from the operation of claim 2. The Examiner also points to page 1560 and the paragraph under Figure 5. This paragraph further recites that concept nodes represent network managed objects. Again, this is different than the event nodes of claim 2. While Ndousse et al., mentions faults, such faults are not equated to events, and further no "fault nodes" appear to be formed. As the reference lacks at least one element of claim 2, the rejection should be reversed.

Claim 3

Claim 3 depends from claim 2 and distinguishes the reference for at least the same reasons. Further, claim 3 recites mapping sampled real-time events to the formed FCM fragments. The Examiner indicates this is disclosed in Figure 2 on page 1559. However, Figure 2 illustrates fault propagation using managed object nodes, and not events. Events, as claimed, do not appear to play a role in the FCM fragments of Ndousse et al., and the rejection should be reversed.

Claim 11

Claim 11 depends from claim 3 and distinguishes the references for at least the same reasons. Further, claim 11 recites that the incoming events are sampled sequentially in the order they are received. The Examiner references page 1558, left col., lines 5-8 of Ndousse et al., as describing this element. However, the cited text merely refers to time-varying aspects, and no

mention of events, real-time events, or sampling is found in Ndousse et al. The rejection should be reversed.

Claim 12

Claim 12 depends from claim 3 and distinguishes the references for at least the same reasons. Further, claim 12 recites identifying a composite set of events that capture the notion of an abstract exception condition in the network. The Examiner cites Figure 5 on page 1560 as describing this element. However, Figure 5 refers to the aggregation of FCMs from multiple experts. It is not seen how it is representative of a composite set of events as claimed.

Claim 22

Claim 22 distinguishes Ndousse et al., in that it clearly indicates that incoming real-time events from the system are sampled, and the sampled events are used to form the FCM fragments.

The Examiner points to page 1558, left col., lines 5-8 of Ndousse et al., as describing the element of claim 1 that includes sampling. This reference to lines of Ndousse et al., is the only analysis provided by the Examiner. There is nothing to indicate how such language describes sampling. As such, the rejection lacks specificity, and the rejection should be reversed. Such langauge of Ndousse et al., if referring to the abstract, indicates that "The dynamic features of FCM are exploited to characterize the time-varying aspects of network faults, while its graphical features are used as a framework for representing the distributed properties of fault propagation." No mention of sampling is found in this language. If the reference is to the Introduction, that recites: "Its essential features provide a rapid and intelligent solution to the following critical issues. – Diagnosis and location of the faulty components of the network." This language fails to describe sampling, and a review of Ndousse et al., reveals no mention of sampling. Still further, no mention of events is found. Since at least one element has not been properly shown to be in the reference, a proper *prima facie* case of anticipation has not been established, and the rejection should be reversed.

Claim 23

Claim 23 depends from claim 22 and recites determining event nodes and concept nodes from determined event nodes. The FCM fragments, including interdependencies between the concept and event nodes are formed using the determined event nodes and the concept nodes. Ndousse et al., in the portions cited by the Examiner: page 1559, left col., lines 41-42 describe the nodes as being representative of objects and concepts, not events and concepts as claimed. Thus, Ndousse et al., functions entirely different from the operation of claim 23. The Examiner also points to page 1560 and the paragraph under Figure 5. This paragraph further recites that concept nodes represent network managed objects. Again, this is different than the event nodes of claim 23. As the reference lacks at least one element of claim 23, the rejection should be reversed.

Claim 25

Claim 25 is a computer readable medium version of claim 1, and is believed allowable for at least the same reasons.

Claim 33

Claim 33 is an independent claim that recites the use of a computer system to diagnose problems from multiple events. It is believed to distinguish the reference in a manner similar to that described with respect to claim 1, as sampling of incoming real-time events is performed. Ndousse et al., does not describe sampling, nor real-time events as a basis for diagnosing problems as claimed. Further, Ndousse et al., uses real experts and aggregates the FCMs of the experts. It does not describe use of a computer to generate FCMs, but instead such FCMs are generated by the experts themselves. Thus, claim 33 distinguishes from Ndousse et al., on many levels, and the rejection should be reversed.

Claim 41

Claim 41 is an independent claim that recites a system to diagnose problems from multiple events. It is believed to distinguish the reference in a manner similar to that described

with respect to claim 1, as sampling of incoming real-time events is performed. Ndousse et al., does not describe sampling, nor real-time events as a basis for diagnosing problems as claimed. Further, Ndousse et al., uses real experts and aggregates the FCMs of the experts. It does not describe use of a system to generate FCMs, but instead such FCMs are generated by the experts themselves. Thus, claim 41 distinguishes from Ndousse et al., on many levels, and the rejection should be reversed.

Claim 42

Claim 42 depends from claim 41 and recites determining event nodes and concept nodes from determined event nodes. The FCM fragments, including interdependencies between the concept and event nodes are formed using the determined event nodes and the concept nodes. Ndousse et al., in the portions cited by the Examiner: page 1559, left col., lines 41-42 describe the nodes as being representative of objects and concepts, not events and concepts as claimed. Thus, Ndousse et al., functions entirely different from the operation of claim 42. The Examiner also points to page 1560 and the paragraph under Figure 5. This paragraph further recites that concept nodes represent network managed objects. Again, this is different than the event nodes of claim 42. As the reference lacks at least one element of claim 42, the rejection should be reversed.

Claim 43

Claim 43 depends from claim 42 and distinguishes the reference for at least the same reasons. Further, claim 43 recites mapping sampled real-time events to the formed FCM fragments. The Examiner indicates this is disclosed in Figure 2 on page 1559. However, Figure 2 illustrates fault propagation using managed object nodes, and not events. Events, as claimed, do not appear to play a role in the FCM fragments of Ndousse et al., and the rejection should be reversed.

D) Discussion of the rejection of claims 19-21, 32, 40, and 59-61 under 35 U.S.C. § 103(a) as being unpatentable over Ndousse as applied to claims 1-18, 22-31, 33-39, 41-58, and 62-63

above, in view of Zhi-Qiang Liu et al., "Contextual Fuzzy Cognitive Map for Decision Support in Geographic Information Systems", and further in view of Thierry Marchant, "Cognitive Maps and Fuzzy Implications."

Claims 19-21, 32, 40, and 59-61 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ndousse as applied to claims 1-18, 22-31, 33-39, 41-58, and 62-63 above, in view of Zhi-Qiang Liu et al., "Contextual Fuzzy Cognitive Map for Decision Support in Geographic Information Systems", and further in view of Thierry Marchant, "Cognitive Maps and Fuzzy Implications." Appellants respectfully traverse the rejection of these claims because a proper *prima facie* showing of obviousness has not been made. The combination of the references do not teach or suggest the invention as claimed, and the references are not combinable, as there is no proper motivation to combine them.

Claim 19

Claim 19 depends from claim 3 and is believed allowable for at least the same reasons. Further, claim 19 recites evaluating the effect of the received event nodes on the concept nodes. The references, alone or combined do not recite the use of event nodes in a method to diagnose problems in a system of managed components. The Examiner indicates that Liu teaches the computation of an indirect effect of concepts in an FCM using the claimed equation. Even if that were the case, it does not provide the missing use of event nodes of the present claim. Marchant is not cited as teaching, disclosing or suggesting the use of event nodes either. Thus, there is no teaching or suggestion of the use of event nodes, and the rejection should be reversed.

Claims 20 and 21

Claims 20 and 21 depend from claim 19. They describe the use of real time events to evaluate the effect of the received events on identified concept nodes. This is a form of dynamically changing the FCM fragments with time and the discovery of new concepts and events. This concept is not disclosed in Ndousse et al., at the cited right column of page 1559. Since an expert is used in Ndousse et al. to create the FCM, it would require the expert to continuously monitor real time traffic and change the model on the fly. This is simply not taught

or suggested. Further, the other references are not recited as providing this element. Thus, a proper *prima facie* case of obviousness has not been established, and the rejection should be reversed.

Claim 32

Claim 32 depends from claim 27 and is believed allowable for at least the same reasons. Further, claim 32 is similar to claim 19 in that it recites evaluating the effect of the received event nodes on the concept nodes. The references, alone or combined do not recite the use of event nodes in a method to diagnose problems in a system of managed components. The Examiner indicates that Liu teaches the computation of an indirect effect of concepts in an FCM using the claimed equation. Even if that were the case, it does not provide the missing use of event nodes of the present claim. Marchant is not cited as teaching, disclosing or suggesting the use of event nodes either. Thus, there is no teaching or suggestion of the use of event nodes, and the rejection should be reversed.

Claim 40

Claim 40 depends from claim 35 and is believed allowable for at least the same reasons. Further, claim 40 is similar to claim 19 in that it recites evaluating the effect of the received event nodes on the concept nodes. The references, alone or combined do not recite the use of event nodes in a method to diagnose problems in a system of managed components. The Examiner indicates that Liu teaches the computation of an indirect effect of concepts in an FCM using the claimed equation. Even if that were the case, it does not provide the missing use of event nodes of the present claim. Marchant is not cited as teaching, disclosing or suggesting the use of event nodes either. Thus, there is no teaching or suggestion of the use of event nodes, and the rejection should be reversed.

Claim 59

Claim 59 depends from claim 43 and is believed allowable for at least the same reasons. Further, claim 59 is similar to claim 19 in that it recites evaluating the effect of the received

event nodes on the concept nodes. The references, alone or combined do not recite the use of event nodes in a method to diagnose problems in a system of managed components. The Examiner indicates that Liu teaches the computation of an indirect effect of concepts in an FCM using the claimed equation. Even if that were the case, it does not provide the missing use of event nodes of the present claim. Marchant is not cited as teaching, disclosing or suggesting the use of event nodes either. Thus, there is no teaching or suggestion of the use of event nodes, and the rejection should be reversed.

Claims 60 and 61

Claims 60 and 61 depend from claim 59 and are believed allowable for at least the same reasons. Further, they both reference evaluating the effect of received event nodes. No such teaching is found or suggested in any of the references, alone or combined. Thus, the rejection should be reversed.

8. SUMMARY

It is respectfully submitted that the art cited does not render the claim anticipated or obvious and that the claims are patentable over the cited art. Reversal of the rejection and allowance of the pending claims is respectfully requested.

Respectfully submitted,

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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being filed using the USPTO's electronic filing system EFS-Web, and is addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 12 day of July, 2006.

John D. Gustav-Wrathall
Name

[signature]
Signature

CLAIMS APPENDIX

1. (Rejected) A method to diagnose a problem from multiple events in a system of managed components generating real-time events of problems, comprising:

forming fuzzy cognitive maps (FCMs) including causally equivalent FCM fragments using network element interdependencies derived from a database defining the network managed objects and event notifications that convey the state of one or more managed objects;

sampling generated incoming real-time events from the system; and

diagnosing problems by mapping the sampled events to the formed FCM fragments.

2. (Rejected) The method of claim 1, wherein forming the FCM fragments comprises:

determining event nodes from events in the database;

identifying concept nodes from the determined event nodes; and

forming FCM fragments including interdependencies between the concept and event nodes using the determined event nodes and the identified concept nodes.

3. (Rejected) The method of claim 2, wherein diagnosing the sampled events comprises:

mapping the sampled real-time events to the formed FCM fragments including determined event nodes to evaluate the effect of the mapped event nodes on the identified concept nodes using the determined interdependencies;

identifying the problems by analyzing the concept nodes based on the outcome of the evaluation; and

diagnosing the problems based on the outcome of the analysis.

4. (Rejected) The method of claim 3, wherein the system comprises:

a system selected from the group consisting of explicit system, implicit system, centralized system, partially centralized system, and distributed system.

5. (Rejected) The method of claim 3, wherein the events comprise:
exceptional conditions occurring in the operation of the network.

6. (Rejected) The method of claim 5, wherein the event nodes comprise:
significant events selected from the group consisting of hardware failures, software failures, performance bottlenecks, configuration problems, and security violations.

7. (Rejected) The method of claim 6, wherein determining the event nodes comprises:
determining the event nodes from a database defining the network managed objects and event notifications that convey the state of one or more managed objects.

8. (Rejected) The method of claim 7, wherein determining the event nodes further comprises:
determining the event nodes from expert knowledge of the network.

9. (Rejected) The method of claim 8, wherein the managed objects comprise:
objects selected from the group consisting of network objects, attached systems, and application objects.

10. (Rejected) The method of claim 8, wherein the database comprises:
static information associated with each class of managed or dynamic information that affects the causal propagation of events.

11. (Rejected) The method of claim 3, wherein sampling the incoming real-time events comprises:
sampling the incoming real-time events sequentially in the order they are received.

12. (Rejected) The method of claim 3, wherein identifying the concept nodes comprises:

identifying a composite set of events that capture the notion of an abstract exception condition in the network.

13. (Rejected) The method of claim 12, wherein the abstract exception condition comprises:

abstract exception conditions selected from the group consisting of a notion of fault and a notion of performance degradation, a network card in a communication system being faulty with the number of users being served by the communication system drastically reducing, and link between two routers going down leading to the use of alternate paths which lead to congestion and performance.

14. (Rejected) The method of claim 12, wherein capturing the abstract exception condition comprises:

capturing normal paths based on predetermined criteria on which the events have to be diagnosed.

15. (Rejected) The method of claim 14, wherein the criteria comprises:

causal and temporal inconsistencies between events.

16. (Rejected) The method of claim 1, wherein forming the FCM, comprises:

capturing system event interdependencies.

17. (Rejected) The method of claim 15, wherein capturing the system event interdependencies comprises:

interconnecting event and concept nodes using interdependency arcs capturing temporal and logical dependencies.

18. (Rejected) The method of claim 17, wherein the interdependency arcs comprise:

weights based on temporal and logical dependencies.

19. (Rejected) The method of claim 3, wherein evaluating the effect of the received event nodes on the concept nodes, comprises:

computing an indirect effect of events (*predictive event-correlation*) on concept nodes using the equations:

$$I_{px}(E_i, C_i) = \min(e_{px}(E_i, C_j)) = \min(e_{px_{r1}}(E_i, E_k)) \oplus \ldots\ldots \oplus \min(e_{px_m}(E_{kn}, C_j))$$

wherein the indirect effect of events E_i on concept nodes C_i can be defined as the intersection of the linked causal types and can be described by the above equation, e_{px} is a function which takes I_{ij} to [0,1] in path 'p' i.e. $e_{Iij} = f \rightarrow (I_{ij}, \mu_{ij})$, $\mu_{ij} \in \{0,1\}$, and $\oplus$ represents a concatenation of paths, wherein the concatenation operator $\oplus$ is generally considered as a fuzzy 'and' operator, wherein the operator (t-norm) for intersection of two fuzzy sets other than 'min' can be used using a 'bounded difference,' wherein the bounded difference can be computed using the equation:

$$t_1(\mu_A(x), \mu_B(x)) = \max\{0, \mu_A(x) + \mu_B(x) - 1\}$$

wherein $t_1()$ is a t-norm between fuzzy sets A and B with membership functions μ_A and μ_B.

20. (Rejected) The method of claim 19, wherein mapping the received real-time events to the formed FCM fragments comprises:

correlating the received events to the identified concept nodes to evaluate the effect of the received event nodes on the identified concept nodes using the determined element interdependencies.

21. (Rejected) The method of claim 20, wherein correlating the received events to the concept nodes further comprises:

accumulating evidence based on the received event nodes;

comparing the accumulated evidence to a threshold value; and

analyzing the concept nodes based on the outcome of the comparing to evaluate the effect of the received event nodes.

22. (Rejected) A method for diagnosing problems from multiple events in a communication network including managed components generating real-time events of problems, comprising:

forming fuzzy cognitive maps (FCMs) including causally equivalent FCM fragments using network element interdependencies;

sampling generated incoming real-time events from the network; and

diagnosing each of the generated problems by mapping the received sampled events to the formed FCM fragments.

23. (Rejected) The method of claim 22, wherein forming the FCM fragments comprises:

determining event nodes from events in the database;

identifying concept nodes from the determined event nodes; and

forming FCM fragments including interdependencies between the concept and event nodes using the determined event nodes and the identified concept nodes.

24. (Rejected) The method of claim 23, wherein diagnosing the sampled events comprises:

mapping the sampled real-time events to the formed FCM fragments including determined event nodes to evaluate the effect of the mapped event nodes on the identified concept nodes using the determined interdependencies;

identifying the problems by analyzing the concept nodes based on the outcome of the evaluation; and

diagnosing the problems based on the outcome of the analysis.

25. (Rejected) A computer readable medium having computer-executable instructions to diagnose problems from multiple events in a system of managed components generating real-time events of problems, comprising:

forming fuzzy cognitive maps (FCMs) including causally equivalent FCM fragments using network element interdependencies derived from a database defining the network managed objects and event notifications that convey the state of one or more managed objects;

sampling generated incoming real-time events from the system; and

diagnosing problems by mapping the sampled events to the formed FCM fragments.

26. (Rejected) The computer readable medium of claim 25, wherein forming the FCM fragments comprises:

determining event nodes from events in the database;

identifying concept nodes from the determined event nodes; and

forming FCM fragments including interdependencies between the concept and event nodes using the determined event nodes and the identified concept nodes.

27. (Rejected) The computer readable medium of claim 26, wherein diagnosing the sampled events comprises:

mapping the sampled real-time events to the formed FCM fragments including determined event nodes to evaluate the effect of the mapped event nodes on the identified concept nodes using the determined interdependencies;

identifying the problems by analyzing the concept nodes based on activation levels of the concept nodes; and

diagnosing the problems based on the outcome of the analysis.

28. (Rejected) The computer readable medium of claim 27, wherein the system comprises:

a system selected from the group consisting of explicit system, implicit system, centralized system, partially centralized system, and distributed system.

29. (Rejected) The computer readable medium of claim 28, wherein the events comprise:

exceptional conditions occurring in the operation of the network.

30. (Rejected) The computer readable medium of claim 29, wherein the event nodes comprise:

significant events selected from the group consisting of hardware failures, software failures, performance bottlenecks, configuration problems, and security violations.

31. (Rejected) The computer readable medium of claim 27, wherein identifying the concept nodes comprises:

identifying a composite set of events that capture the notion of an abstract exception condition in the network.

32. (Rejected) The computer readable medium of claim 27, wherein evaluating the effect of the received event nodes on the concept nodes, comprises:

computing an indirect effect of events on concept nodes using the equations:

$$I_{px}(E_i, C_j) = \min(e_{px}(E_i, C_j)) = \min(e_{px_{r1}}(E_i, E_k)) \oplus \ldots\ldots \oplus \min(e_{px_{rn}}(E_{kn}, C_j))$$

wherein the indirect effect of events E_i on concept nodes C_i can be defined as the intersection of the linked causal types and can be described by the above equation, e_{px} is a function which takes I_{ij} to [0,1] in path 'p' i.e. $e_{Iij} = f \rightarrow (I_{ij}, \mu_{ij})$, $\mu_{ij} \in \{0,1\}$, and $\oplus$ represents a concatenation of paths, wherein the concatenation operator $\oplus$ is generally considered as a fuzzy 'and' operator, wherein the operator (t-norm) for intersection of two fuzzy sets other than 'min' can be used using a 'bounded difference,' wherein the bounded difference can be computed using the equation:

$$t_1(\mu_A(x), \mu_B(x)) = \max\{0, \mu_A(x) + \mu_B(x) - 1\}$$

wherein $t_1()$ is a t-norm between fuzzy sets A and B with membership functions μ_A and μ_B.

33. (Rejected) A computer system to diagnose problems from multiple events in a system of managed components generating real-time events of problems, comprising:

a storage device;

an output device; and

a processor programmed to repeatedly perform a method, comprising:

forming fuzzy cognitive maps (FCMs) including causally equivalent FCM fragments using network element interdependencies derived from a database defining the network managed objects and event notifications that convey the state of one or more managed objects;

sampling generated incoming real-time events from the system; and

diagnosing problems by mapping the sampled events to the formed FCM fragments.

34. (Rejected) The system of claim 33, wherein forming the FCM fragments comprises:

determining event nodes from events in the database;

identifying concept nodes from the determined event nodes; and

forming FCM fragments including interdependencies between the concept and event nodes using the determined event nodes and the identified concept nodes.

35. (Rejected) The system of claim 34, wherein diagnosing the sampled events comprises:

mapping the sampled real-time events to the formed FCM fragments including determined event nodes evaluate the effect of the mapped event nodes on the identified concept nodes using the determined interdependencies;

identifying the problems by analyzing the concept nodes based on the outcome of the evaluation; and

diagnosing the problems based on the outcome of the analysis.

36. (Rejected) The system of claim 35, wherein the events comprise:

exceptional conditions occurring in the operation of the network.

37. (Rejected) The system of claim 35, wherein the event nodes comprise:

significant events selected from the group consisting of hardware failures, software failures, performance bottlenecks, configuration problems, and security violations.

38. (Rejected) The system of claim 35, wherein identifying the concept nodes comprises:

identifying a composite set of events that capture the notion of an abstract exception condition in the network.

39. (Rejected) The system of claim 35, wherein forming the FCM, comprises:

capturing system event interdependencies by interconnecting event and concept nodes using interdependency arcs that capture temporal and logical dependencies.

40. (Rejected) The system of claim 35, wherein evaluating the effect of the received event nodes on the concept nodes, comprises:

computing an indirect effect of events on concept nodes using the equations:

$$\mathbf{I}_{px}(E_i, C_i) = \min(e_{px}(E_i, C_j)) = \min(e_{px_{r1}}(E_i, E_k)) \oplus \ldots\ldots \oplus \min(e_{px_m}(E_{kn}, C_j))$$

wherein the indirect effect of events E_i on concept nodes C_i can be defined as the intersection of the link causal types and can be described by the above equation, e_{px} is a function which takes I_{ij} to [0,1] in path 'p' i.e. $e_{Iij} = f \rightarrow (I_{ij}, \mu_{ij})$, $\mu_{ij} \in \{0,1\}$, and $\oplus$ represents a concatenation of paths, wherein the concatenation operator $\oplus$ is generally considered as a fuzzy 'and' operator, wherein the operator (t-norm) for intersection of two fuzzy sets other than 'min' can be used using a 'bounded difference,' wherein the bounded difference can be computed using the equation:

$$t_1(\mu_A(x), \mu_B(x)) = \max\{0, \mu_A(x) + \mu_B(x) - 1\}$$

wherein $t_1()$ is a t-norm between fuzzy sets A and B with membership functions μ_A and μ_B.

41. (Rejected) An event-correlation system to diagnose problems from multiple incoming real-time events in a communication network of managed components generating real-time events of problems, comprising:

an event-analyzer to form fuzzy cognitive map (FCM) fragments using network element interdependencies derived from a database defining the network managed objects and event notifications that convey the state of one or more managed objects; and

an event-processing module coupled to the event-analyzer to sample generated incoming real-time events from the network, wherein the analyzer to diagnose the problems from the sampled events by mapping the sampled events to the formed FCM fragments.

42. (Rejected) The event-correlation system of claim 41, wherein the analyzer forms FCM fragments by determining event nodes from events in the database, and by further identifying concept nodes from the determined event nodes to form FCM fragments including interdependencies between the identified concept nodes and the determined event nodes.

43. (Rejected) The event-correlation system of claim 41, wherein the analyzer further maps the sampled events to the formed FCM fragments including determined event nodes to evaluate the effect of the mapped events on the determined concept nodes using the determined interdependencies, wherein the analyzer identifies the problems by analyzing the concept nodes based on the outcome of the evaluation and further diagnoses the problems based on the outcome of the analysis.

44. (Rejected) The event-correlation system of claim 43, wherein the communication network comprises:

a system selected from the group consisting of explicit system, implicit system, centralized system, partially centralized system, and distributed system.

45. (Rejected) The event-correlation system of claim 43, wherein the events comprise: exceptional conditions occurring during operation of the network.

46. (Rejected) The event-correlation system of claim 45, wherein the event nodes comprise:

significant events selected from the group consisting of hardware failures, software failures, performance bottlenecks, configuration problems, and security violations.

47. (Rejected) The event-correlation system of claim 46, wherein the analyzer determines the event nodes from a database defining the network managed- objects and event notifications that convey the state of one or more managed objects.

48. (Rejected) The event-correlation system of claim 47, wherein the analyzer determines the event nodes from expert knowledge of the network.

49. (Rejected) The event-correlation system of claim 48, wherein the managed objects comprise:

objects selected from the group consisting of network objects, attached systems, and application objects.

50. (Rejected) The event-correlation system of claim 48, wherein the database comprises:

static information associated with each class of managed objects or dynamic information that affects the causal propagation of events.

51. (Rejected) The event-correlation system of claim 43, further comprising:

a communication interface module coupled between the network and the event-processing module to extract events from real-time messages received in different formats from the network and to further sample the extracted events sequentially in the order they are received.

52. (Rejected) The event-correlation system of claim 43, wherein the analyzer identifying the concept nodes comprises a composite set of events that capture a notion of an abstract exception condition in the network.

53. (Rejected) The event-correlation system of claim 52, wherein the abstract exception condition comprises conditions selected from the group consisting of a notion of fault and a notion of performance degradation.

54. (Rejected) The event-correlation system of claim 52, wherein the analyzer captures the abstract exception condition by capturing normal paths based on predetermined criteria from which for the events are diagnosed.

55. (Rejected) The event-correlation system of claim 54, wherein the criteria comprises:

causal and temporal inconsistencies between events.

56. (Rejected) The event-correlation system of claim 43, wherein the analyzer forms FCM by capturing system event interdependencies.

57. (Rejected) The event-correlation system of claim 56, wherein the analyzer captures system interdependencies by interconnecting event and concept nodes using interdependency arcs to capture temporal and logical dependencies.

58. (Rejected) The event-correlation system of claim 57, wherein the interdependency arcs comprise:

weights based on temporal and logical dependencies.

59. (Rejected) The event-correlation system of claim 43, wherein the analyzer evaluates an indirect effect of events on concept nodes using the equations:

$$\mathbf{I}_{px}(E_i, C_j) = \min(e_{px}(E_i, C_j)) = \min(e_{px_{r1}}(E_i, E_k)) \oplus \ldots\ldots \oplus \min(e_{px_m}(E_{kn}, C_j))$$

wherein the indirect effect of events E_i on concept nodes C_i can be defined as the intersection of the link causal types and can be described by the above equation, e_{px} is a function which takes I_{ij} to [0,1] in path 'p' i.e. $e_{Iij} = f \rightarrow (I_{ij}, \mu_{ij})$, $\mu_{ij} \in \{0,1\}$, and $\oplus$ represents a

concatenation of paths, wherein the concatenation operator $\oplus$ is generally considered as a fuzzy 'and' operator, wherein the operator (t-norm) for intersection of two fuzzy sets other than 'min' can be used using a 'bounded difference,' wherein the bounded difference can be computed using the equation:

$$t_1(\mu_A(x), \mu_B(x)) = \max\{0, \mu_A(x) + \mu_B(x) - 1\}$$

wherein $t_1()$ is a t-norm between fuzzy sets A and B with membership functions μ_A and μ_B.

60. (Rejected) The event-correlation system of claim 59, wherein the analyzer maps the received real-time events to the formed FCM fragments by correlating the received events to the identified concept nodes to evaluate the effect of the received event nodes on the identified concept nodes using the determined element interdependencies.

61. (Rejected) The event-correlation system of claim 59, wherein the analyzer correlates the received events by accumulating evidence based on the received event nodes and compares the accumulated evidence to a threshold value, and analyzes the concept nodes based on the outcome of the comparing to evaluate the effect of the received event nodes.

62. (Rejected) The event-correlation system of claim 43, further comprising:

an interface output module coupled to the event-analyzer to output one or more solutions based on the outcome of diagnosing the problems by the analyzer.

63. (Rejected) The event-correlation system of claim 62, further comprising:

a memory to store the static and dynamic information.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.